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Amdt. dated January 10, 2006
Reply to Office Action of September 7, 2005

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REMARKS/ARGUMENTS

Claims 2-32 are rejected under 35 U.S.C. § 112, paragraph, as being indefinite and as being incomplete for omitting essential elements. Claims 2-32 are rejected under 35 U.S.C. § 101 as being directed to non-statutory subject matter and as lacking patentable utility. Claims 2, 4-15, and 17-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng; (US Patent No. 6,658,071) in view of Ross et al. (US Patent No. 6,128,765). Claims 3 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng and Ross in view of Crozier et al. (US Patent No. 6,145,114). Claims 31 and 32 are rejected under 35 U.S.C. 103(e) as being unpatentable over Cheng in view of Benedetto et al. ("Soft-Output Decoding Algorithms in Iterative Decoding of Turbo Codes") in further view of Ross et al.

Summary of Interview

An interview with the Examiner attended by inventor Dr. Keith Chugg and the undersigned was conducted on December 15, 2005. Claims 2-32 and reference Cheng (US Patent No. 6,658,071) were discussed. Proposed amendments to claims 2, 15, 29, 30, 31, and 32 were discussed, including amendments adding only "forward truncated survivor path" and "backward truncated survivor path" to the claims. Applicant made arguments regarding Cheng's lack of disclosure of both a "forward truncated survivor path" and a "backward truncated survivor path." The Examiner indicated that there may exist certain "window-based" prior art references that have not been cited but may be applicable. No conclusion regarding patentability was reached. The Examiner advised the Applicant to submit amendments in a Request for Continued Examination (RCE).

Rejections Under 35 U.S.C. § 112

Definiteness/Completeness

As amended, claims 2-32 are believed to comply with the requirements under 35 U.S.C. § 112, second paragraph. Claims 2-32 as amended no longer recite claim language previously rejected by the Examiner as being indefinite and/or incomplete.

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<u>Rejections Under 35 U.S.C. § 101</u>

<u>Statutory Subject Matter</u>

As currently amended claims 2-32 recite methods and systems for generating higher confidence information on data inputs of a process modeled as a finite state machine (FSM). These methods and systems fall squarely within the statutorily defined categories of "process" and "machine." Further, because claims 2-32 are directed to methods and systems for generating higher confidence information on data inputs of a process, they are not directed to "an abstract algorithm." Accordingly, amended claims 2-32 are directed to patentable subject matter under 35 U.S.C. § 101.

Applicants also respectfully submit that the status of the present invention as patentable subject matter is not defeated merely because the invention is generally described in the preamble. The preamble must be taken into account if limitations found in the body of the claim rely on the preamble for completeness. As the Examiner puts it: "A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, *and where the body of the claims does not depend on the preamble for completeness* but, instead, the process steps for structural limitations are able to stand alone. See In re Hirao, 535 F.2d 67, 190, USPQ 15 (CCPA 1976) and Kropa v. Robie, 187 F.2d 150, 152; 88 USPQ 487, 481 (CCPA 1951)." See Office Action dated 9/7/2005, p. 10, first paragraph (emphasis added). Here, the limitation of "higher confidence information" recited in the body of the claims <u>does</u> depends on the preamble for completeness. For example, claim 2 recites:

2. A method for <u>generating higher confidence information on data inputs of a process modeled as a finite state machine (FSM)</u> represented by a reduced-state trellis, the FSM receiving a plurality of FSM inputs and producing a plurality of FSM outputs, the FSM inputs being defined on a base set of symbols, the method comprising:
    (a) inputting said soft decision information in a first index set;
    (b) performing forward recursion calculations on said reduced-state trellis representation using said input soft decision information and using a forward truncated survivor path comprising decisions not specified by the reduced-state trellis, to produce forward state metrics;
    (c) performing backward recursion calculations on said reduced-state trellis representation using said input soft decision information and using a backward truncated survivor path comprising decisions not specified by the reduced-state trellis, the backward truncated survivor path being distinct from the forward truncated survivor path, to produce backward state metrics;

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(d) operating on said forward state metrics and said backward state metrics to produce said higher confidence information; and
(e) outputting said higher confidence information (emphasis added).

Clearly, the preamble provides the antecedent basis for the limitation of "said higher confidence information" as recited in steps (d) and (e) of the body of the claim. That is, the recitations of "said higher confidence information" in steps (d) and (e) refer to the "higher confidence information" generated "on data inputs of a process modeled as a finite state machine (FSM)...," as recited in the preamble. Without reading this language from the preamble, the recitations of "said higher confidence information" in steps (d) and (e) would make little sense. The limitation of "higher confidence information" as recited in the body of the claims thus depends on the preamble for completeness. Accordingly, the preamble's description of "higher confidence information" cannot be read out of the claims for purposes of determining patentable subject matter.

In light of the above, the methods and systems for generating higher confidence information on data inputs of a process modeled as a finite state machine (FSM), as recited in claims 2-32, fall squarely within the statutorily defined categories of "process" and "machine" and are directed to patentable subject matter under 35 U.S.C. § 101.

Utility

As currently amended claims 2-32 recite methods and systems for generating higher confidence information on data inputs of a process modeled as a finite state machine (FSM). As is well known to one of ordinary skill in the art, a wide range of processes may be modeled as finite state machines in fields such as data communications, processing, and storage. For example, in a communication system, these processes may include trellis code modulation (TCM) encoding, inter-symbol interference (ISI), etc. See e.g., Application at p. 4, lines 19-22 and 28-33, and p. 5, lines 1-10. By generating higher confidence information on data inputs of such processes, data in the communication system may be reconstructed with better accuracy and less error. This is clearly useful.

Applicants also respectfully submit that the utility of the present invention is not defeated merely because the invention is generally described in the preamble. As explained

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previously, the limitation of "higher confidence information" recited in the body of the claims does depends on the preamble for completeness. For this reason, the preamble's description of "higher confidence information" cannot be read out of the claims for purposes of determining utility of the present invention.

Indeed, both the preamble and the body describe the invention, which in the case of claim 2 is a useful method for "generating higher confidence information on data inputs of a process modeled as a finite state machine (FSM)." The preamble of claim 2 generally describes the method for "generating higher confidence information on data inputs of a process modeled as a finite state machine (FSM)." The body of claim 2 specifically describes the steps performed for "generating higher confidence information on data inputs of a process modeled as a finite state machine (FSM)." Thus, the body of claim 2 does provide patentable utility, by reciting steps of a useful method. Similarly, in each of the remaining claims 3-33, the invention as recited in the body does provide patentable utility.

In light of the above, the methods and systems for generating higher confidence information on data inputs of a process modeled as a finite state machine (FSM), as recited in claims 2-32, possess patentable utility under 35 U.S.C. § 101.

Rejections Under 35 U.S.C. § 103

Claim 2

Claim 2 overcomes the rejection under 35 U.S.C. § 103. As amended, claim 2 recites, amongst other features: "(b) performing forward recursion calculations on said reduced-state trellis representation using said input soft decision information and using a forward truncated survivor path comprising decisions not specified by the reduced-state trellis, to produce forward state metrics;" and "(c) performing backward recursion calculations on said reduced-state trellis representation using said input soft decision information and using a backward truncated survivor path comprising decisions not specified by the reduced-state trellis, the backward truncated survivor path being distinct from the forward truncated survivor path, to produce backward state metrics;" (emphasis added). These claimed features are well supported by the present application, and no new matter is introduced. Support for these features can

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clearly be found in specific embodiments described in Fig. 3, equations 6 and 7, and accompanying descriptions on pp. 5-7 of the present application as filed.

Cheng fails to disclose a forward recursion calculation on a reduced-state trellis representation using a forward truncated survivor path and a backward recursion calculation on the reduced-state trellis representation using a backward truncated survivor path distinct from the forward truncated survivor path, as recited in claim 2. Cheng discloses a delayed decision feedback Log-MAP equalizer that re-uses the same modified received sequence $r_n{}^{\wedge}(i)$ defined in equation 19 of Cheng, for both the forward recursion and the backward recursion. As the Examiner puts it:

> "Cheng teaches that the $r_n{}^{\wedge}(i)$ of equation 19 are required for calculation of the forward recursion α metrics in equations 20 and 33 ... they are passed to the backward recursion calculation module unmodified and unaffected by the forward recursion calculations of equations 20 and 33 ... [Cheng] teaches that both forward recursion α metrics of equations 20 and 33 and backward recursion β metrics in equations 24 and 37 depend from the same $r_n{}^{\wedge}(i)$ of equation 19" (emphasis added).[1] See Office Action dated 9/7/2005, p. 8, first paragraph.

Cheng simply re-uses the same modified received sequence $r_n{}^{\wedge}(i)$ in the forward recursion and the backward recursion. Thus, even if is assumed that the modified received sequence $r_n{}^{\wedge}(i)$ is considered a forward truncated survivor path, Cheng still fails to further disclose the use of a backward truncated survivor path distinct from the forward truncated survivor path in performing backward recursion calculations. Indeed, by teaching re-use of the same $r_n{}^{\wedge}(i)$ in both the forward and back ward recursions, Cheng actually teaches away from the use of a backward truncated survivor path that is distinct from the forward truncated survivor path used in the forward recursion calculations. For at least this reason, Cheng clearly fails to disclose, and in fact teaches away from, the invention as recited in claim 2.

Ross et al. fails to make up for the deficiencies of Cheng. Ross et al. is directed to a traditional *full-state* maximum a posteriori estimator (as opposed to reduced-state). Because

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[1] The $r_n{}^{\wedge}(i)$ of equation 19 is actually calculated during the forward recursion calculations of equations 20, 21, and 22. Specifically, each forward recursion results in the selection of a prior state of the surviving branch, selected as the prior state having the maximum accumulated metric defined in equation 22. This selection of the prior state recursively updates the value of $x_i()$, which is used in the calculation of the $r_n{}^{\wedge}(i)$ of equation 19. Thus, the $r_n{}^{\wedge}(i)$ of equation 19 is indeed calculated during the forward recursion. This $r_n{}^{\wedge}(i)$ of equation 19 is then re-used in the backward recursion calculations of equation 24.

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the estimator in Ross is full-state, the states completely define the path used in recursion

calculations. See e.g., Ross et al., Fig. 2, equations 4-10 and accompanying text. As such, there

in no need to use any truncated survivor paths at all, be it forward or backward. In other words,

because Ross's full-state trellis completely specifies decisions in the forward and backward

paths, there cannot exist any "forward truncated survivor path comprising decisions not specified

by the reduced-state trellis." Similarly, there cannot exist any "backward truncated survivor path

comprising decisions not specified by the reduced-state trellis." Thus, Ross et al. not only fails

to disclose but in fact teaches away from the invention as recited in claim 2.

For these reasons stated above, claim 2 is patentable over Cheng and Ross et al.,

either individually or in combination.

Claims 15 and 29-32

In dependent claims 15 and 29-32 are rejected based on at least the same rationale

as that used for rejecting claim 2 based on Cheng and Ross. For at least the reasons stated above

with respect to claim 2, claims 15 and 29-32 are also patentable over the cited prior art

references. Specifically with respect to claims 31 and 32, neither Ross et al. nor Benedetto et al.

makes up for the deficiencies of Cheng. As such, claims 15 and 29-32 are patentable over the

cited references.

Claims 3-14 and 16-28

Dependent claims 3-14 and 16-28 depend from claims 2 and 15, respectively.

Each of claims 3-14 and 16-28 incorporates all of the limitations of its respective independent

claim and is therefore patentable over the cited references for at least the reasons stated above

with respect to claims 2 and 15.

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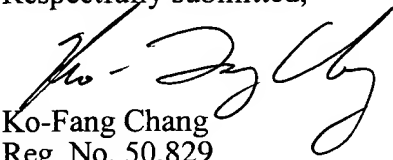Reply to Office Action of September 7, 2005

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CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

Ko-Fang Chang
Reg. No. 50,829

TOWNSEND and TOWNSEND and CREW LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
Tel: 650-326-2400   Fax: 415-576-0300
KC:djb
60596803 v1